Land Information System for Efficient Lands Administration and Revenue Generation: A Case Study of Trans-Amadi Industrial Layout, Port Harcourt, Nigeria

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ABSTRACT
Land management could be enhanced through effective land administration, which involves the processes of land registration, Cadastre, valuation and land inventory. Manual Land Administration has been in use by the Ministry of Lands and Survey in Port Harcourt since its inception. The city and its surrounding have been expanding rapidly beyond projections. With this rapid expansion, manual Land Administration has become inefficient, time-consuming and prone to abuses, whereby some land officers siphon revenues generated, because of inefficient land transaction records; hence, a digital, scientific, and operational approach of Land Administration was adopted by development of an Integrated Land Information System. However, this has been achieved by conversion of existing land related information to digital formats with the aid of relevant software like MS Excel, MS Access, AutoCAD Land Development and ArcGIS 9.2 and the combination of necessary queries and analysis. The results show an efficient, effective and proper Land Administration and revenue generation procedure.
Key Words: Cadastre, Land Administration, LIS, ArcGIS, revenue generation.

1.0 Introduction
Land is the most valuable possession of mankind. It is also an important asset of any country. Without land, there can be no country. Then, the wealth of the nation and its economic development are dependent on the state of the land and its usage. The availability of funds depends on tax collection. It is apparent, therefore, any information concerning land is valuable information which serves as a key to financial investments, commerce, industry and agriculture.

Although land is part of man's natural heritage, access to land is controlled by ownership patterns. Land is partitioned for administrative and economic purposes, and it is used and transformed in a myriad of ways. Land information is prime requisite for making decisions related to land investment, development and management. Information reduces uncertainty by helping to identify and analyze problems.(Enermark, 1999) It is also recognized that digital Land information systems must be tailored to facilitate an efficient land market as well as effective land-use administration and thereby, more generally, promote economic development, social cohesion and sustainable development. Cadastral systems must serve a multi-purpose use and thereby meet the challenge of a modern GIS and IT environment.

This research covers a wide range of land information system; and synchronizing different administrative procedures and effective means of generating land related revenue, which have been used presently. Land records are very important because these form the basis for the proposed land reform programme of the Federal Government of Nigeria.

1.1 Definitions
- ❖ **Land Information System**: Land Information System (LIS) is a "tool for legal, administrative and economic decision making and an aid for planning and development which consists of a database containing spatially referenced land related data for a defined area and of procedures and techniques for the systematic collection, updating, processing and distribution of that data". (Dale , 2000), (Chandrasekhar, 2000)
- ❖ **Cadastre**: The International Federation of Surveyors (FIG, 1995) defines a cadastre as a "parcel based and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, ownership or control of those interests, and often the value of the parcel and its improvements. It may be established for fiscal purposes (valuation and taxation), legal purposes (conveyancing), to assist in the management of land and land-use control (planning and administration), and enables sustainable development and environmental improvement".
- ❖ **Land Administration**: The term "land administration" is defined as the processes of recording and disseminating information about the ownership, value and use of land and its associated resources. Such

processes include the determination (sometimes known as the "adjudication") of rights and other attributes of the land, the survey and description of these, their detailed documentation and the provision of relevant information in support of land markets.

❖ **Land Revenue Generation**: Land revenue generation methods is a process whereby value can be determined, property tax collection and the nature of land and property markets. It stresses the importance of land and property in the national economy. It considers the costs and benefits of improving land administration systems and reviews the potential for recovering fully the costs of operating a land information system.

1.2 Aim and Objectives

The aim of this project is to emphasis on the development of Land Information system of Trans-Amadi Industrial Layout, Port Harcourt, Rivers State Nigeria, using application software like Ms-Access, AutoCAD Land Development and ArcGIS 9.2; and how it can be used as a tool for efficient land administration and revenue generation through relevant queries of database and spatial analysis.

❑   Specifically the Objectives includes:
1. Conversion of existing coordinates of all survey beacons in trans-Amadi industrial layout from NTM to UTM (Universal Traverse Mercator) coordinate system.
2. Vectorization of existing analogue layout plan of Trans-Amadi industrial with AutoCAD land development using coordinates of all existing beacons in the layout plan.
3. Creation of database by capturing all the required spatial and attribute data.
4. Querying of the created database
5. Running of spatial analysis

1.3 Scope of the Project

The scope of the work involves detailed procedures for the development of Land Information System of Trans-Amadi Industrial layout, Port Harcourt, Rivers State. The project is limited to showing parcel, boundaries, road network, land use, properties, surrounding creek, survey plans of each plot; and the attributes includes instruments to land title (e.g. C of O), land registry data and survey attributes data. All these entities and attributes will form the base for database creation.

2.0 Literature Review

The issue of inefficiencies posed by manual method of keeping land records has become a topical issue in the world, especially developing countries like Nigeria.(Arnot, 2006)

Magaji Galadima – AGIS: The Journey so Far (2006): In his words stated categorically that the former Department of Land Administration and Resettlement was operating a manual system of land record management. These were plagued by numerous bottlenecks and cumbersome, widespread forgeries, document laundering, and racketeering of land. According to him other problems of land administration include cases of multiple allocation, unattended applications, allocations from "Parallel Ministry" mismatches in land use, and encroachments. Other worrisome problems include inefficient revenue generation and collection, as well as delays in issuing/perfecting transactions in land.

In the same vein, Adeoye (2006): During 5th FIG Regional Conference, Accra, Ghana; posits that Manual record-keeping has been in use by Land related Departments of the Ministry of the Federal Capital Territory (MFCT) and the Federal Capital Development Authority (FCDA) since the inception of the Federal Capital Territory almost 30 years ago. The city and its surrounding have been expanding rapidly beyond projections. With this rapid expansion, manual record-keeping became inefficient, time-consuming and prone to abuses. Several unsuccessful attempts were made in the past to solve the problems. The attempt failed because of the gross under estimation of the gravity of the problems and the ill-defined scope of the project. The primary reason that has hindered the computerization of the Cadastral and Land Registry records in the past is lack of a strong political will on the part of the authority hence the need to eliminate paper based system.(Arnot, 2006).

A land administration system provides a mechanism that supports the management of real property. The processes of land administration include the regulating of land and property development, the use and conservation of the land, the gathering of revenues from the land through sales, leasing, and taxation; and the resolving of conflicts concerning the ownership and use of the land (Dale and McLaughlin 1988).

Developing a good land information system in Nigeria will be hindered by so many obstacles as stated by Asoegwu, R.N. (unpublished 2000):

• Most parcels of land have not been located by proper surveys that are tied to the national framework of controls;
• The records of land already surveyed are either not available or faulty;
• The records that are pertinent to the parcels of land properly surveyed are not located in a central place or places that are integrate able;

- Inadequate laws that could enforce the compulsory collection of appropriate land data;
- Ignorance on the part of experts to appreciate the need for land records;
- Reluctance of some governments to fund adequately long-term projects that do not yield immediate profits;
- Initial high cost/financial barrier.

3.0 Materials and Methods

3.1 Data Sources

The analogue layout plan and its Pillar coordinates were acquired from the office of Surveyor General of Rivers state. The layout was surveyed on 29th September, 1975 and the origin of the survey is PHCIS. It consists of **two hundred and twenty (222)** plots with arterial roads within. The pillar coordinates will be used to generate the digital layout plan.   Some of the land records (cadastre) were acquired from the departments of lands and registry of Ministry of Lands and Survey, Rivers State. An Ikonos imagery of 2008 covering area of study was acquired from Megatech Earth Digital System Limited. The imagery will be used for some important analysis.

3.2 Methods

❑   **Procedures In Layout Plan Conversion To Digital Format**

- The acquired coordinates in NTM was typed in Ms-Excel and converted to UTM coordinate system, Minna Datum with *GeoCalc*. Software.
- The coordinates were arranged in Notepad in the following format:

_Point Eastings, Northings.(for the pillar point)

_Text Eastings, Northings , Text size, Text orientation (90˚) , and Pillar No

The two files (script) were saved in .scr extension and later, these scripts were imported in *AutoCAD* window as points and text respectively, each points having pillar number inscription.

 The pillar points are joined with polyline to form plots; and bearings, distances and areas of the plots are auto labeled subsequently. Then the final layout is exported to DXF file format.

In ArcGIS Enviroment

- The Autocad DXF file is converted to Shapefile using the conversion tool. This serves as the shapefile for the Parcels
- Other shapefiles were created in ArcGIS, they are; Roads, Building, River, Railway and Boundary pillars.

❑ **Layers Creation, Attribute Editing And Digitization In Arcgis**

- All the created shapefiles and the Ikonos Imagery covering the area of study into ArcGIS enviroment in different layers were imported
- Two new fields "Plot No" and "Area" were added in the Attribute Table of the Parcel Shapefile and type the plot No and calculated the area of the parcels using *Geometry Calcualtor*
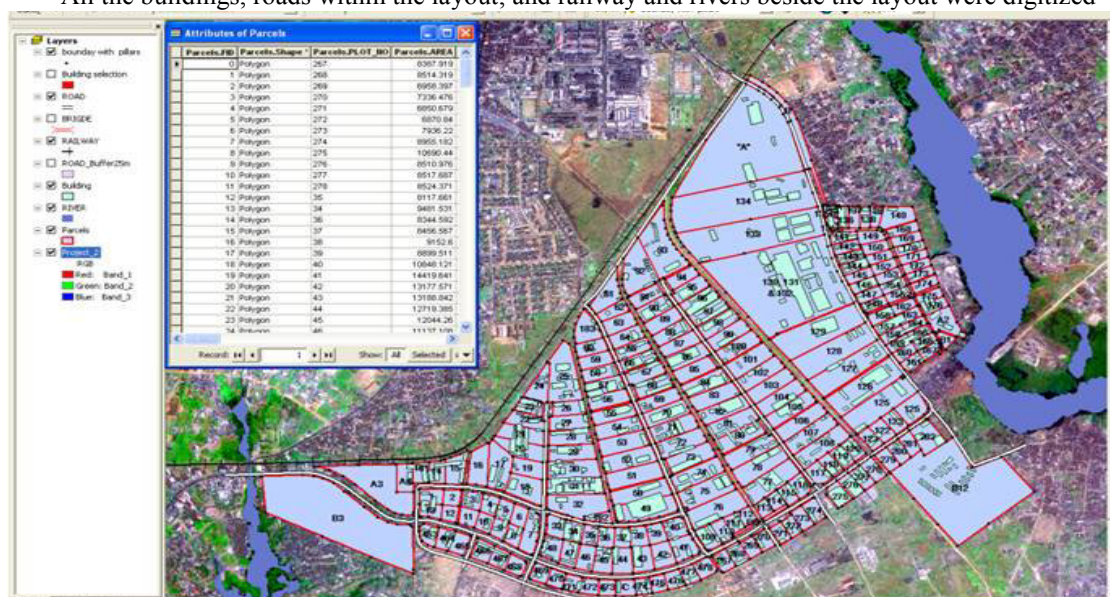- All the buildings, roads within the layout; and railway and rivers beside the layout were digitized

Figure 1: Parcels, roads, river, imagery, railway in layers displayed in ArcGIS

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❑ **Creation Of Database In Ms-Access**

A form in Ms-Access was created, which was an interface used for data capture into the database
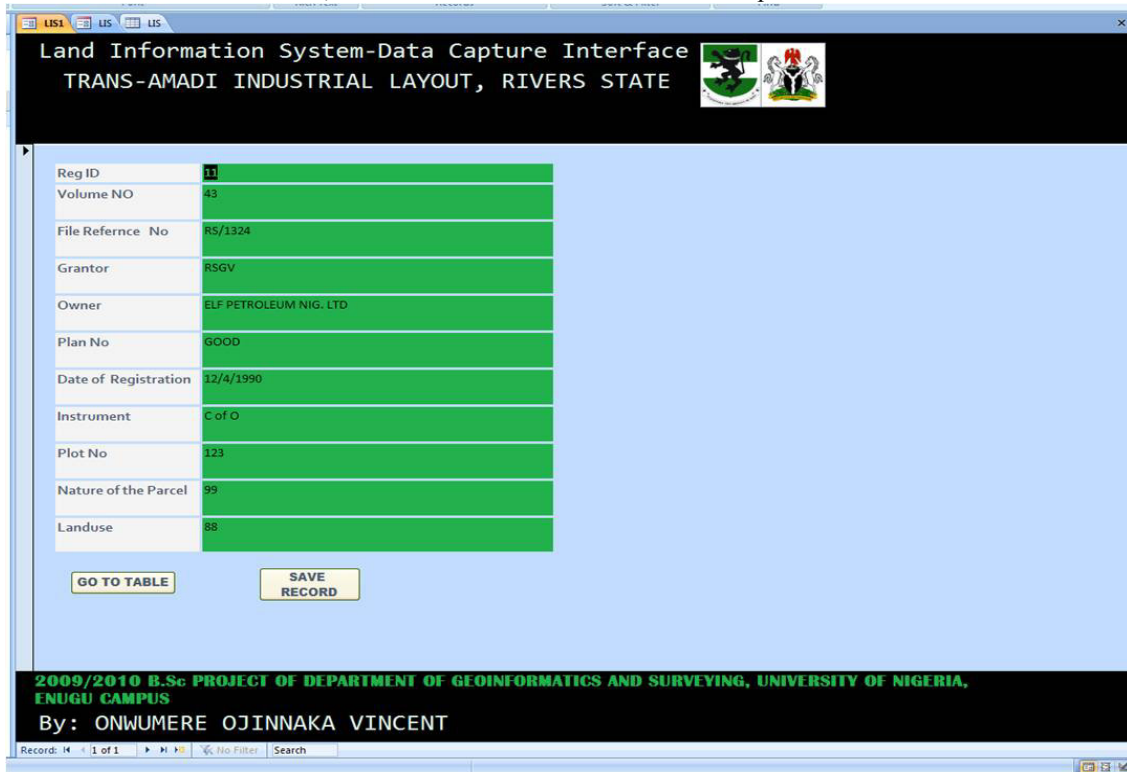

Fig.2 Ms-Access Form

In the parcel database the following fields (columns) exist:

Registration ID (Reg. ID), Volume No., File Reference No., Grantor, Owner, Date of Registration, Instrument, Plot No., Land Use, Nature of the Parcel, Plan No.,

In the rent database the following fields exist:

• Parcel Owner, Plot No., Monthly Rent per plot, Annual Rent per Plot

They were linked to the second table using Plot No as the primary key.
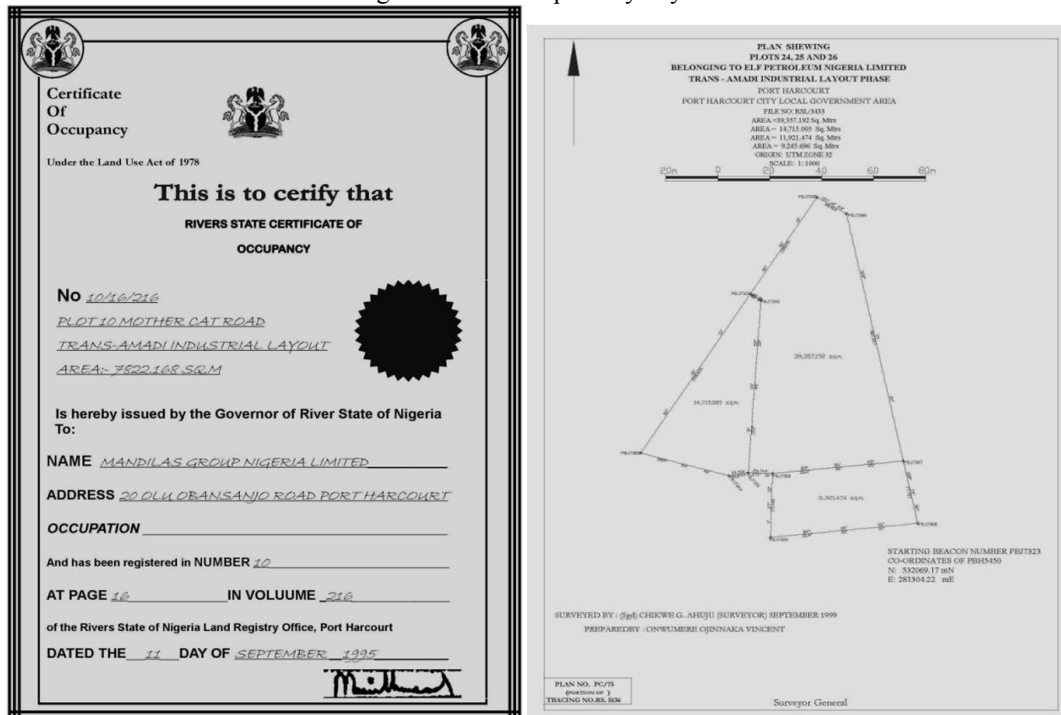
Fig.3 The C of O and Cadastral survey plan were scanned and hyperlink to parcels.

4.0 LIS Database Queries, Results and Analysis

In order to achieve the objectives of this project, the following queries and analysis were performed on the Land Information Database.

4.1 Queries

- ❋ Query1 on ownership information.
- ❋ Query2 on property identification using any of the following: Plot No, Plan No, File Reference No, Volume No and Registration Identification No
- ❋ Query3 on Land Use.
- ❋ Query4 on Plot Not Developed.
- ❋ Query5 Monthly Rent payable by a property owner based on 20 Naira per sq.m.
- ❋ Query6 on Instruments or Title over Property
- ❋ Query7 on Hyperlink of Parcel Instrument Document
- ❋ Query8 on Hyperlink of Survey plan of Parcels

4.2 Analysis and Results
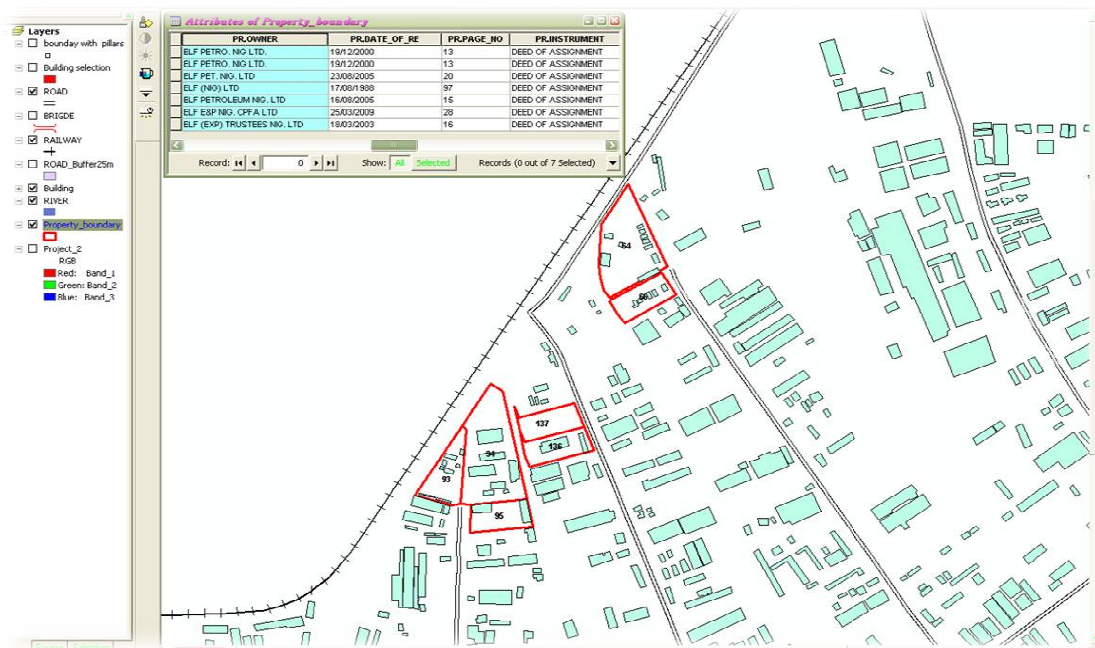
Fig.4 QUERY 1: Ownership Information-E.g. Which parcels are owned by Elf Petroleum?
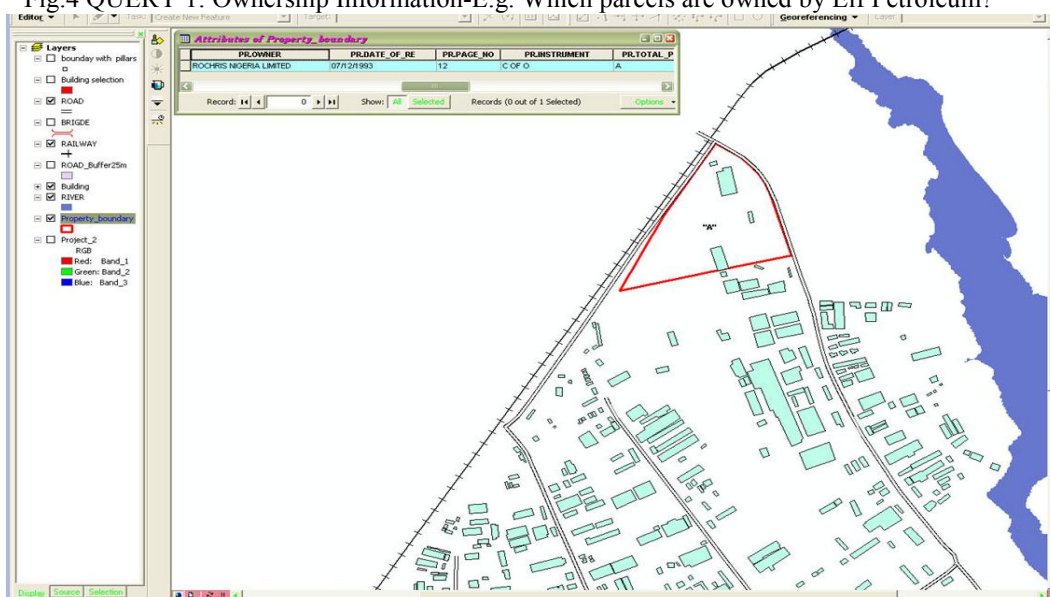

Fig.4 QUERY 2: Property Identification using any of the following; Plot No, Plan No, File Reference No, Volume No, and Registration Identification – E.g. who is the owner of property with Plot number "A"?
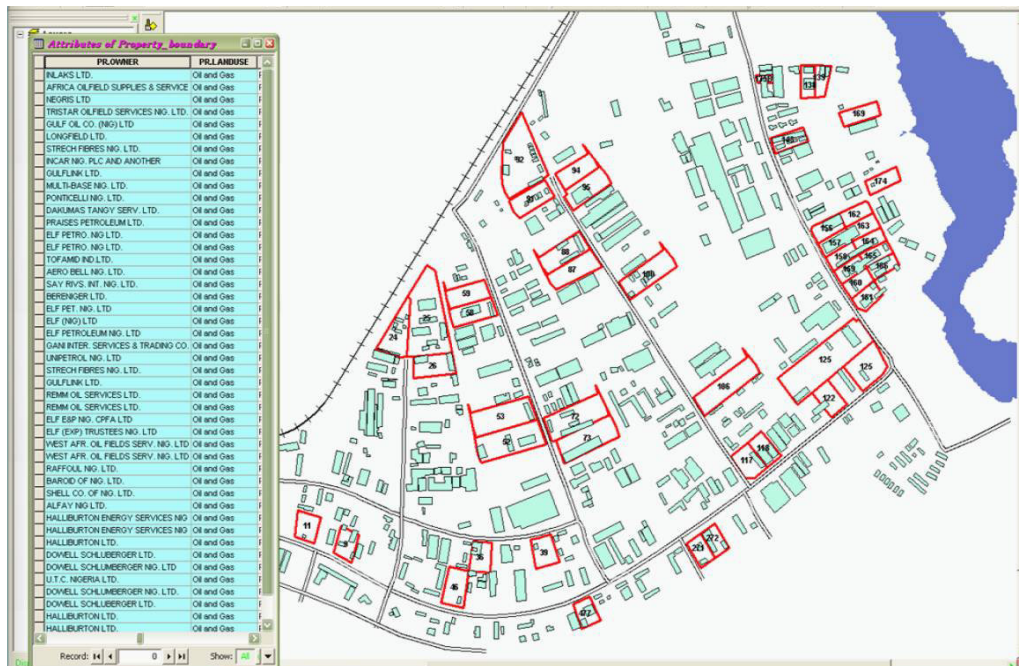
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Fig.5 QUERY 3: Land use Identification- E.g. Identify the parcels occupied by Oil and Gas companies?
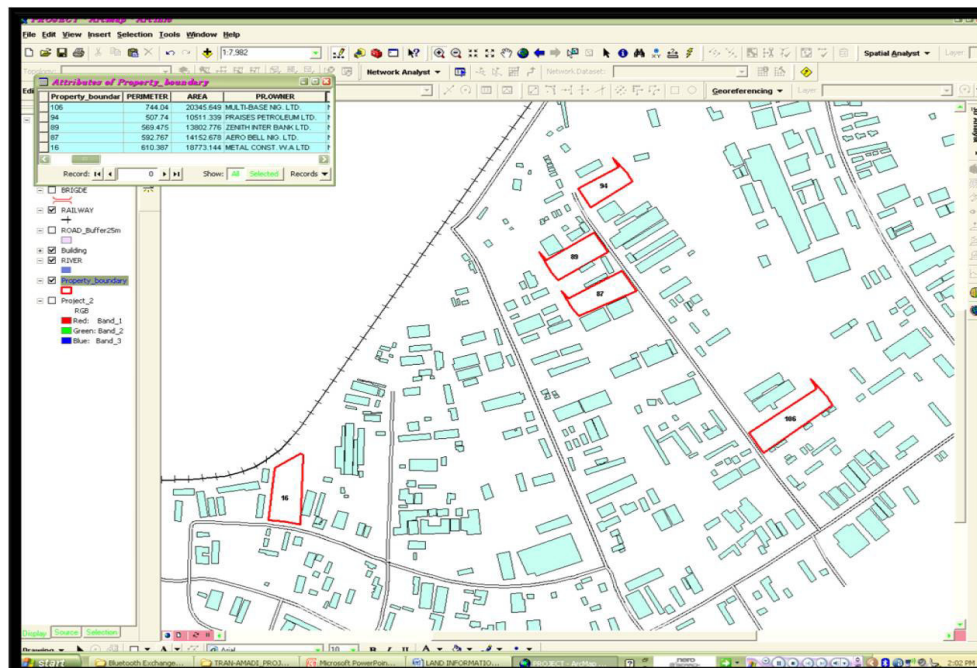

Fig.6 QUERY 4: Query on Plot Not Developed. - E.g. Identify parcels not developed?
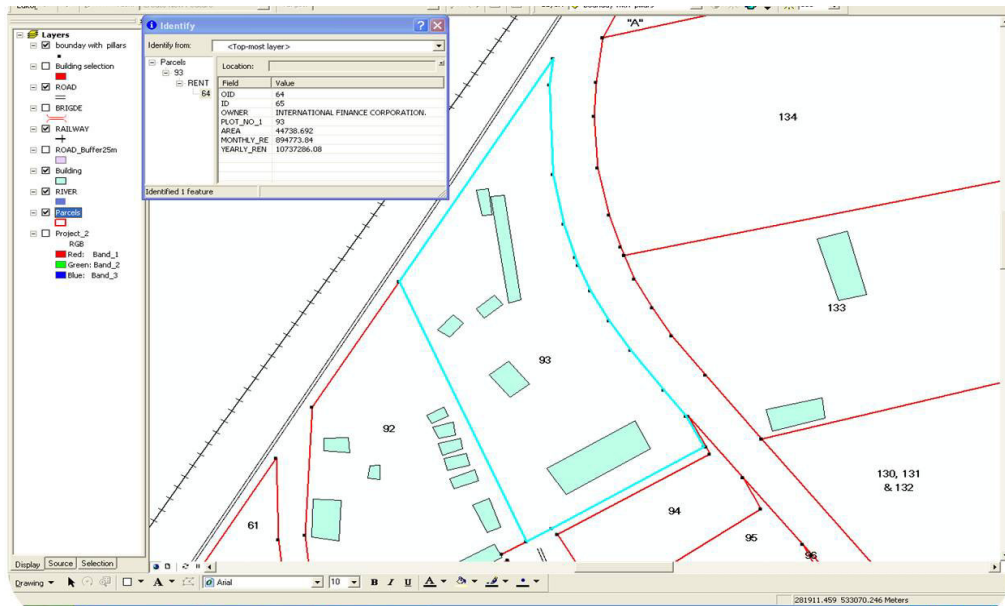
Fig.7 QUERY 5: Query Monthly and Annual Rent payable by a property owner based on 20 Naira per sq.m.-
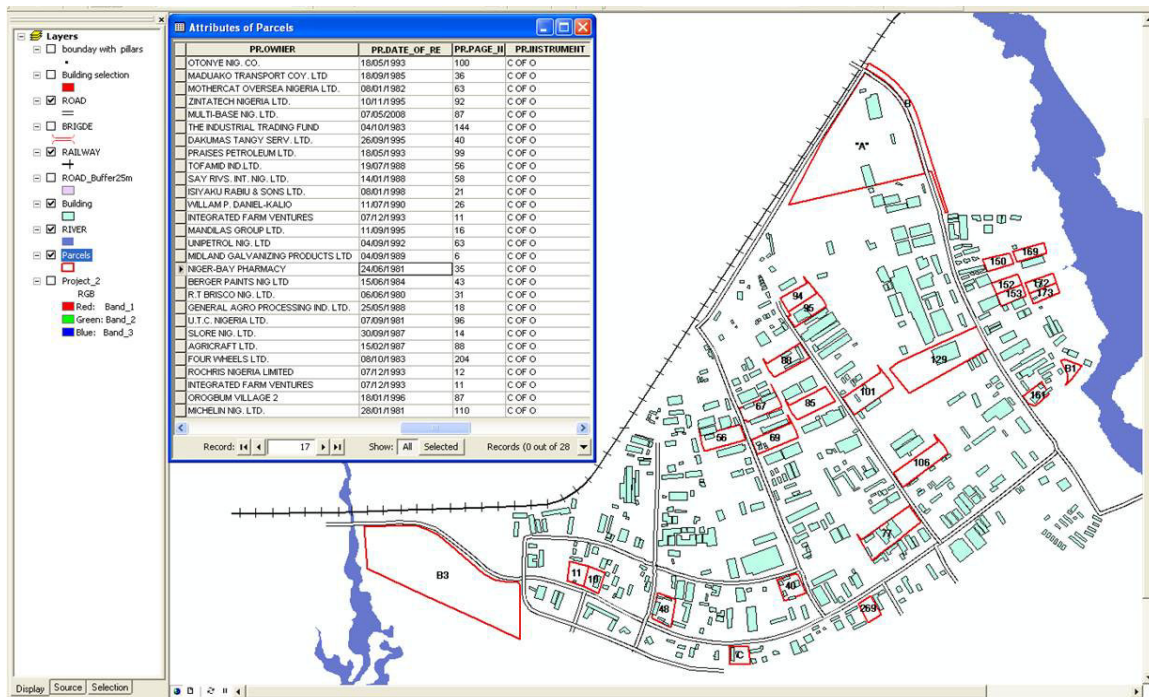E.g. what is the monthly and yearly rent to be paid by the owner of Plot No. 93 ?

Fig.8 QUERY 6: Query on Instruments or Title over Property- E.g. identify all parcels with C of O?
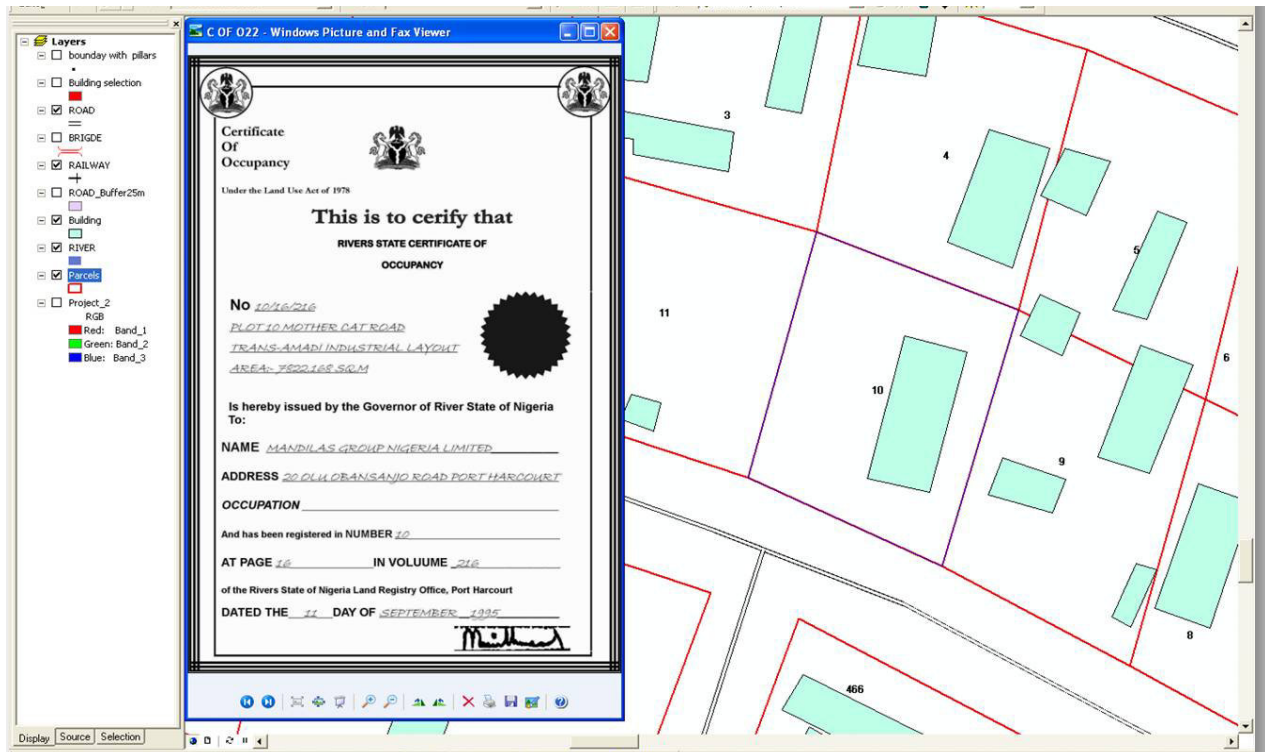
Fig.9 QUERY 7: Query on Hyperlink of Parcel Instrument Document and –
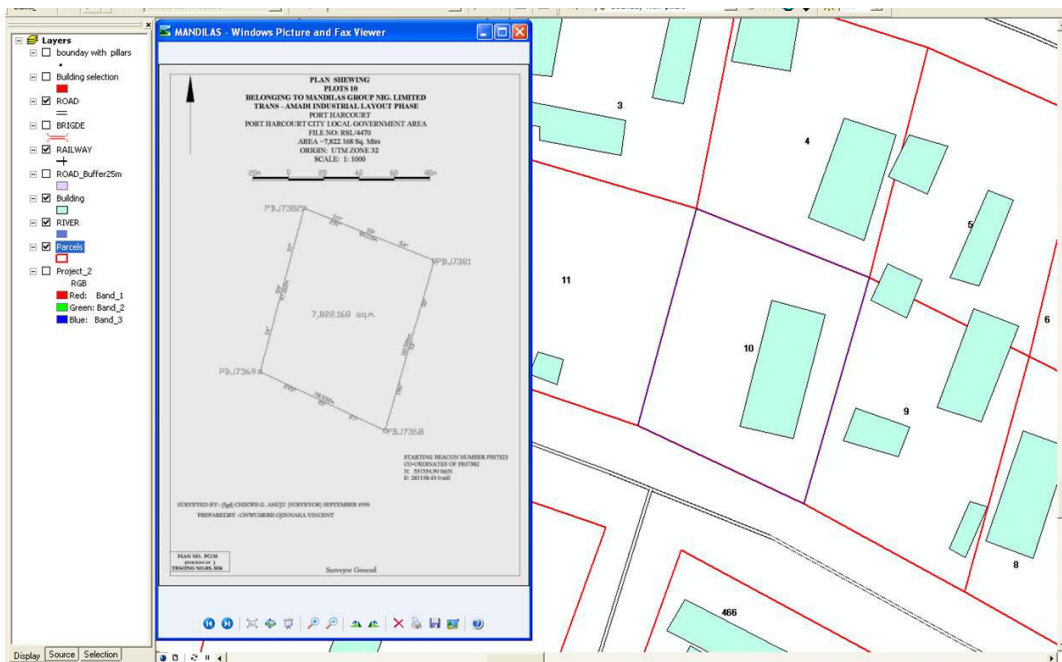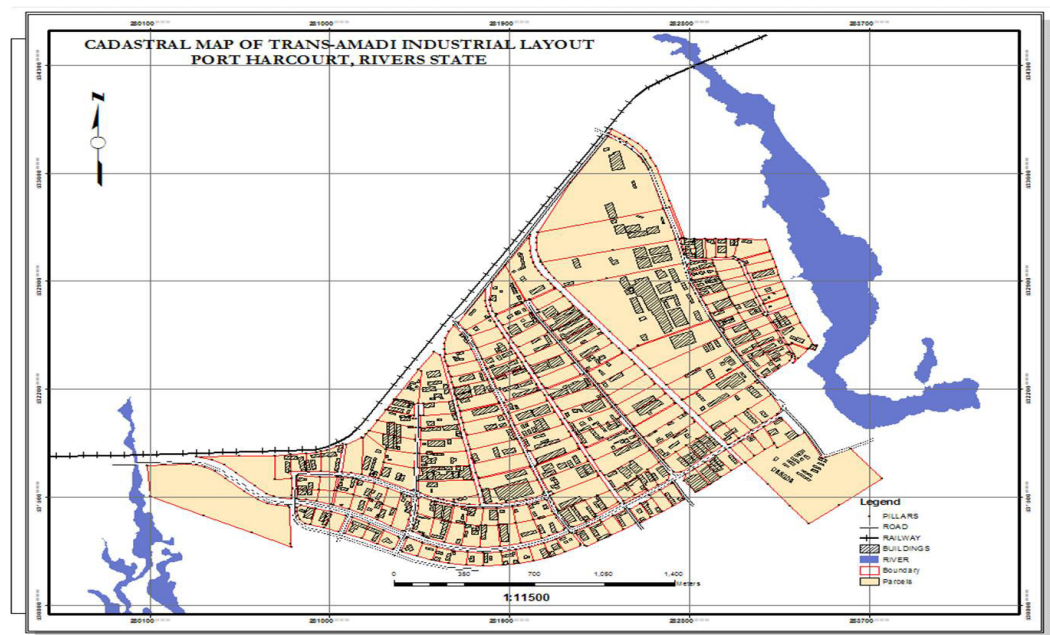E.g. Display the C of O and Survey Plan of Plot No 10?

Fig.10 QUERY 8: Query on Hyperlink of Survey plan of Parcels- E.g. Display the Survey Plan of Plot No 10?

Fig. 11 Digital Cadastral Map of Trans-Amadi Industrial Layout

5.0 Summary Of Results

In this project Land information system has been identified as tool for proper land administration and revenue generation by considering its development and implementation, using Trans-Amadi industry layout, Port Harcourt, Rivers State as a case study.

The benefits of implementation of land information system such as guarantee of ownership and security of tenure, support for land and property taxation, security for credit, develop and monitor land markets, protect state lands, reduce land disputes, improve urban planning and infrastructure development, support for environmental management and production of statistical data.

The feature class layers such as parcels, boundary pillars, road, building, river, and railway were created with ArcGIS; and the parcel database created with MS-Access for good database management system.

In order to show how land information can be used as a tool for land administration and revenue generation, some selected database queries and analysis were performed; the queries and results are as follows:

1. **Which parcels are owned by Elf Petroleum?** Plot Numbers 24, 25, 26, 58, 59, 91 and 92 belongs to Elf Petroleum Nigeria Limited.
2. **Who is the owner of with Plot N0 "A"?** Plot No "A" belongs to ROCHRIS NIGERIA LIMITED.
3. **Identify the parcels occupied by Oil and Gas companies?** Forty seven (47) out of two hundred and twenty two (222) parcels are occupied by Oil and Gas companies.
4. **Identify parcel not developed?** Parcels with Plots Numbers 16, 87, 89, and 94 are not developed.
5. **What is the monthly and yearly rent to be paid by the owner of Plot No. 93?** the Owner of Plot No 93 (INTERNATIONAL FINANCE CORPORATION) is suppose to pay 894773.84 Naira and a total of 10737286.08 Naira as Monthly and Annual rent respectively at 20 Naira per sq.m .
6. **Identify all parcels with C of O?** Twenty eight (28) out of two hundred and twenty two (222) parcels have certificate of occupancy (C of O).
7. **Identify Parcels that have encumbrances?** Eighty seven (87) out of two hundred and twenty two (222) parcels are identified to have encumbrances.
8. **Display the C of O and Survey Plan of Plot No 10?** The Instrument Document (Certificate of Occupancy) of Plot No. 10 belonging to Mandilas Group Nigeria limited displays.
9. **Display the Survey Plan of Plot No 10?** The Survey Plan of Plot No 10 belonging to Mandilas Group Nigeria limited displays.
   Analysis
10. **Selection of Buildings without 3 meters set-back to the road to maintain Right of Way (ROW) using Buffering-** seventy four (74) buildings the buildings that did not observe 3 meters set-back from the road were selected.

The results of the database queries and analysis helped in achieving the aim of the project.

6.0 Conclusions and Recommendations

There is an increasing awareness that land administration has a wider community and even global imperative (Adeoye 2006). Linked to this, Trans-amadi industrial layout is the industrial hub of Rivers state and major source of land revenue; requires land information system. Establishment of LIS of Trans-amadi industrial layout is an integral to the realization of that vision. The knowledge conveyed in this project has considerable potential support to the people of Rivers state in providing humankind/land relationship and information for decision makers (land administrators) that will enable them to make decisions favorable to sustainable development in the context of efficient land administration and management.

In the light of the observation drawn from the discussions and results of queries and analysis above, the use of the LIS will gradually improved efficiency and increased productivity in various aspects of services offered at the Ministries of Lands and Surveys and it is hereby recommend that:

- De-centralization of information should be implemented to make it easier to keep track of and to recall information.
- There should be Transparency in all land dealings with due process and accountability being the key watch words. In line with this the ministry will published and displayed fees charged for different services offered.
- Simplified official procedures - a faster and more effective way of moving files should be developed.
- Reduction in waiting times for obtaining information on land matters should be curtailed to the barest minimum. The Survey and Registry should publish a 'Registration Procedure Booklet" to convey the requirements for each of their Registration Procedures.
- Installation of a state of the art security and fire alarm system with security monitors should be placed in strategic locations around the Registry will lead to a higher level of confidence on the part of customers/users. All visitors should wear badges for easy identification.
- Setting up of a call centre for enquiries and complaints by users of the Registry. Alongside the establishment of the LIS progress should be made in the production of digital base maps to provide accurate and up to date information.
- An ethos of staff training should be developed and computer training a watchword. External Consultants should be given training in Customer Service, Change Management, Time Management, Project Management, Supervisory Management, and Systems Administration.
- Ministry of lands and survey should establish a website, which will enable e-payment of rents, application for C of O and making enquiries about land in the state.

Finally, it is imperative to express at this juncture that this LIS of Trans Amadi l/out is a pilot project that should be implemented in the entire land in Rivers state for efficient land administration and revenue generation in line with the current land reform programme of the Federal Government of Nigeria. .

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